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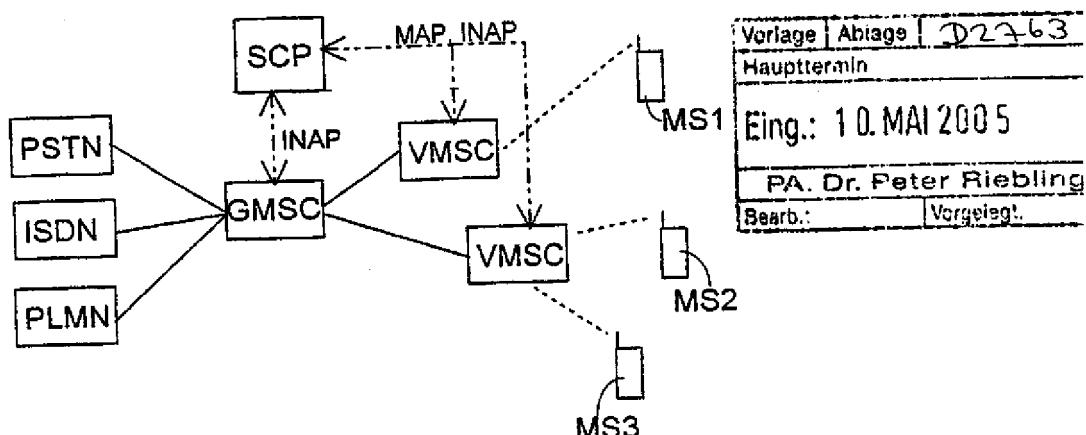
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(54) Title: AUTOMATIC CALL DISTRIBUTION SYSTEM



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(57) Abstract: A method and a mobile communication system for transmitting calls. The mobile communication system comprises at least one mobile services switching centre, a service control point for an intelligent network and at least one terminal communicating with the mobile services switching centre. Subscriber status information and location information on the terminal as well as information on an incoming call to the terminal are transmitted from the mobile services switching centre to the intelligent network service control point. At the control point, the subscriber status information on the terminal is checked and a command is transmitted to the mobile services switching centre either to connect the call to the terminal in response to the fact that the subscriber status information on the terminal indicates that the terminal is able to receive the call or to arrange the incoming call in a queue in response to the fact that the subscriber status information on the terminal indicates that the terminal has such a status which does not allow it to receive the call. Information on the calls in the queue is maintained in the control point wherefrom a command is transmitted to the mobile services switching centre to connect a first call in the queue to the terminal in response to the fact that the subscriber status information on the terminal indicates that the terminal is able to receive the call.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

AUTOMATIC CALL DISTRIBUTION SYSTEM

The invention relates to implementing an automatic call distribution system in mobile communication systems.

The invention relates particularly to a method for transmitting calls
5 in a mobile communication system comprising at least one mobile services switching centre, a service control point for an intelligent network and at least one terminal communicating with the mobile services switching centre.

The invention further relates to a mobile communication system comprising at least one mobile services switching centre, a service control point for an intelligent network and at least one terminal communicating with 10 the mobile services switching centre.

The invention further relates to a service control point for an intelligent network arranged to be operatively connected with at least one mobile services switching centre.
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In public telecommunication networks, such as mobile communication networks, a customer of a network, i.e. a subscriber, is provided with different services, such as voice and fax calls and short message transmission. In addition, subscribers are provided with different bearer services that determine data transmission rates to be used, for example. The increasing demand
20 for telecommunication services has introduced a need to improve the tele-services so as to enable as high subscriber reachability as possible which, on the other hand, can also be controlled by the subscribers themselves. The subscribers also wish to control the costs of the services used. Based on these needs, different supplementary services have been developed for tele-
25 communication networks, including call forwarding, call barring, call holding and call cost reminding. Some of the supplementary services are typically free for all subscribers, while some are chargeable, requiring a separate subscription to a network operator.

Similar supplementary services have also been developed for digital
30 mobile communication networks. For example, with the standardization of so-called phases 2 and 2+ of the GSM (Global System for Mobile Communication) system, several supplementary services have been created to enable a mobile subscriber to improve and control his or her reachability and to reduce the connection costs. The supplementary services provided are always operator-specific; therefore, besides the demand, also the technology of the network infrastructure used determines the services to be provided. Information
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on the supplementary services subscribed to by a subscriber is stored in network elements of the mobile communication network, typically in a home location register HLR.

In the digital mobile communication networks, such as the GSM system, standardized supplementary services create a basis for what kind of services the network operators are able to provide for the subscribers. Several supplementary services, such as automatic redialling, conditional call forwarding, conditional call barring, calling number identification and conference call, were standardized in phase 2 of the GSM system. Several new supplementary services utilizing the GSM system even more efficiently, such as network-based caller name display, multiple subscriber profiles, more advanced call forward functions and various billing services, have been developed in phase 2+ of the standardization.

A problem in the above-described arrangement is that despite many new supplementary services, the digital mobile communication systems, the GSM system in particular, do not, nevertheless, enable calls to be arranged in a queue. This would be extremely important when, for example, a call is made to mobile-station-based service numbers or when a connection is to be established to otherwise high-traffic destinations, such as IT support persons or maintenance staff in companies. In such a case, the number is often busy, but the network system does not enable a plurality of callers to be arranged in a queue to the desired number. An automatic busy number recall uses a considerable amount of the network capacity, but the function yet does not arrange the callers in a queue in order of made calls, but a call to a released number is made in completely random order. Typically, the implementation of queuing requires a separate private branch exchange PBX to be installed in a company, which, as far as small companies in particular are concerned, means considerable costs.

An object of the invention is thus to provide a method and an apparatus implementing the method so as to mitigate the above problems. The objects of the invention are achieved by a method which is characterized by

- transmitting subscriber status information and location information on the terminal to the intelligent network service control point,
- transmitting information on an incoming call to a call number from the mobile services switching centre to the service control point,

selecting, at the service control point, a first terminal to which the call received by the call number is to be directed,

checking, at the service control point, subscriber status information on said first terminal, and

5 transmitting a command from the service control point to the mobile services switching centre to alternatively:

connect the call to said first terminal in response to the fact that the subscriber status information on said terminal indicates that the terminal is able to receive the call or

10 arrange the incoming call in a queue in response to the fact that the subscriber status information on said first terminal indicates that the terminal has such a status which does not allow the terminal to receive the call.

A mobile communication system of the invention is characterized in that

15 the mobile services switching centre is arranged to transmit subscriber status information and location information on the terminal to the intelligent network service control point,

the mobile services switching centre is arranged to inform the service control point of an incoming call to a call number,

20 the service control point is arranged to select a first terminal to which the call received by the call number is to be directed, to check subscriber status information on said first terminal, and to transmit a command to the mobile services switching centre to alternatively:

connect the call to said first terminal in response to the fact that the subscriber status information on said terminal indicates that the terminal is able to receive the call or

25 arrange the incoming call in a queue in response to the fact that the subscriber status information on said first terminal indicates that the terminal has such a status which does not allow the terminal to receive the call.

30 A service control point of the invention is characterized in that

the service control point is arranged to receive and store subscriber status information and location information on the terminals, and

to control queue build-up and call connecting of incoming calls to the terminals at the mobile services switching centre on the basis of said subscriber status information and location information.

According to a preferred embodiment of the invention, information on the calls in a queue is maintained at said control point. Furthermore, according to a preferred embodiment of the invention, a command is transmitted from said control point to a gateway mobile service switching centre to connect

5 the first call in the queue to said terminal in response to a change in the subscriber status information on the terminal such that the terminal can receive the call. Furthermore, according to a preferred embodiment of the invention, the terminal is activated in an automatic call distribution system by transmitting an activation message from the terminal.

10 The idea underlying the invention is that the intelligent network service control point gives the gateway mobile service switching centre instructions to connect calls to terminals included in the call distribution system, and information on the terminals is maintained in the service control point. If a terminal is busy or inaccessible, incoming calls to said terminal can be arranged

15 in a queue to the gateway mobile service switching centre. The service control point maintains queue build-up information and gives the gateway mobile service switching centre instructions to connect the calls in the queue when the terminal becomes free to receive a new call.

An advantage of the method and the system of the invention is that

20 the invention enables a network-based call queuing and distribution system to be created in a mobile communication environment, which eliminates the need for small companies in particular to have a separate telephone exchange of their own. Furthermore, the invention enables a queuing system of incoming calls to a particular service number and distribution of the calls to a plurality of

25 terminals. A further advantage of the invention is that the invention can preferably be implemented mainly as software updates at the intelligent network service control point, whereby no new network elements are needed. An advantage of a preferred embodiment of the invention is that users of the terminals in the call distribution system can themselves control their activation in

30 said system, in which case business calls, for example, can be arranged to be directed to the terminal during business hours only. Furthermore, according to a preferred embodiment of the invention, certain information on terminals in the mobile communication system is maintained in the home location register of the mobile communication system, in which case the arrangement of the

35 invention also supports roaming in other mobile communication networks.

The invention is now described in closer detail in connection with the preferred embodiments and with reference to the accompanying drawings, in which

Figure 1 shows a mobile communication system according to a
5 GSM system,

Figure 2 shows relevant parts of a mobile communication system of
the invention,

Figure 3 is a signalling diagram showing a change in an activation
status of a terminal according to the invention,

10 Figure 4 is a signalling diagram showing how a call is connected
according to the invention,

Figure 5 is a signalling diagram showing another case of connecting
a call according to the invention, and

15 Figure 6 is a signalling diagram showing a call transfer according to
a preferred embodiment of the invention.

On the basis of Figure 1, a typical GSM system network environment utilizing supplementary services will be described. A GSM system comprises mobile stations MS communicating with base transceiver stations BTS over a radio path. Several base transceiver stations BTS are connected to a
20 base station controller BSC, which controls the radio frequencies and channels used by the base transceiver stations BTS. The base station controllers BSC, in turn, communicate with a mobile services switching centre MSC, which is responsible for connection setup and routing calls to correct destinations. Two databases comprising information on mobile subscribers are utilized for the purpose: a home location register HLR and a visitor location register VLR. The home location register HLR comprises information on all subscribers to the mobile communication network and the services they subscribe to: teleservices, bearer services and supplementary services. The visitor location register VLR comprises information on visiting mobile stations in the area
25 of a particular mobile services switching centre MSC. The mobile services switching centres MSC can further be grouped into visited mobile services switching centres VMSC, which, in turn, communicate with other mobile services switching centres and a public switched telephone network PSTN via a gateway mobile services switching centre GMSC. For a more detailed description
30 of the GSM system, reference is made to ETSI/GSM specifications and
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The GSM System for Mobile Communications by M. Mouly and M. Pautet, Palaiseau, France, 1992, ISBN: 2-957190-07-7.

As far as the supplementary services are concerned, the mobile services switching centres MSC and both the home location register HLR and the visitor location register VLR play an important role in the above-described system. Subscriber information is stored in the home location register HLR. The subscriber information comprises subscriber identification information, subscriber-specific tele- and bearer service descriptions and the related restrictions and supplementary service descriptions, which also comprise the status of each supplementary service; whether a subscriber has been registered as a user of the supplementary service and whether the supplementary service has been activated. The visitor location register VLR maintains information on mobile stations in the area of a certain mobile services switching centre MSC; identification information on the mobile stations and their location and on the supplementary service descriptions transmitted from the home location register HLR to the visitor location register VLR in connection with registration. The mobile services switching centres MSC receive the information related to the subscribers' supplementary services in connection with call setup either from the home location register HLR or the visitor location register VLR, and the mobile services switching centres MSC carry out functions specified in the supplementary service descriptions on the basis of this information. The mobile stations MS comprise a subscriber-specific subscriber identity module SIM card, and the subscriber identification information therein is transmitted to the network. The subscriber-specific supplementary service descriptions can be retrieved from the home location register HLR or the visitor location register VLR on the basis of this identification information. Many supplementary services can be activated by an MMI (Man-Machine Interface) user interface of the mobile station MS, but some services are activated by contacting the service provider or the network operator, which activates a desired supplementary service on request.

In the following, the invention will be described in accordance with Figure 2. The invention will be described, by way of example, based on the GSM system but the invention can be implemented in any corresponding telecommunication system which comprises similar network elements. For example, a so-called third generation mobile communication system being developed called a universal mobile telecommunication system UMTS will be based

on the GSM network architecture and, as far as the invention is concerned, comprise similar essential network elements to those in the GSM system used as an example here. Hence, the present invention can also be implemented in the UMTS system.

5 Figure 2 shows a gateway mobile services switching centre GMSC. Incoming calls to the gateway mobile services switching centre GMSC are routed further to mobile stations MS1 to MS3 located in the area of visited mobile services switching centres VMSC. Typically, calls to the gateway mobile services switching centre GMSC are received from a public switched telephone network/integrated services digital network PSTN/ISDN or either from the same or another public land mobile network PLMN. To illustrate the invention, Figure 2 shows the visited mobile services switching centres VMSC and the gateway mobile services switching centre GMSC as separate mobile services switching centres, but the mobile communication network may also 10 comprise only one mobile services switching centre, which, in that case, as far as the invention is concerned, operates both as the logical gateway mobile services switching centre and the visited mobile services switching centre. This is also the case when a mobile station to which calls are routed is located 15 in the area of the gateway mobile services switching centre GMSC. Furthermore, a data transmission connection is arranged from said mobile services switching centres GMSC, VMSC to a service control point SCP of an intelligent network IN. The data transmission connection can preferably be implemented by using a mobile application part MAP or an intelligent network application part INAP protocols, which are known per se in the mobile station and intelligent network environments.

20 The invention utilizes a method known per se of using intelligent-network-based solutions in connection with a mobile communication network, particularly for implementing supplementary services. The intelligent network solutions enable supplementary services to be implemented with no need for 25 the service implementation in itself to be carried out according to any standard. This is accomplished by separating from each other the logical elements of the system which implement call connecting and supplementary services.

30 In the intelligent networks, an element of the system implementing a supplementary service is called a service control point SCP. Regardless of the location of the subscriber, the control point SCP controls all incoming and outgoing calls of a mobile subscriber. The intelligent networks enable the sup-

plementary services provided by a home operator to be used even when the mobile subscriber is located in the area of a visited public landline mobile network VPLMN, which has a so-called roaming agreement with the home operator of the mobile subscriber, and the visited public landline mobile network
5 VPLMN supports said supplementary service. If the mobile subscriber is in the area of the visited public landline mobile network VPLMN, a home public landline mobile network HPLMN provides the visited public landline mobile network with all necessary information on the subscriber. The supplementary service descriptions specifying the supplementary services of each subscriber
10 are stored in the home location register HLR, the supplementary service descriptions typically comprising separate reference information on incoming and outgoing calls and specifying in which service control point SCP instructions for use can be found. The control point SCP typically comprises a service control function SCF, which is responsible for updating the supplementary
15 service descriptions in the home location register HLR and maintaining location information on the mobile subscribers. When the mobile subscriber enters the area of the visited public landline mobile network, the necessary supplementary service descriptions are updated also in the visitor location register VLR of the visited public landline mobile network. In connection with the mobile services switching centre MSC of the visited public landline mobile network is located a service switching function SSF, which is responsible for
20 checking the supplementary service descriptions of the visiting mobile subscriber, particularly for outgoing calls. The intelligent network solution used can preferably be a customized applications for mobile enhanced logic CAMEL
25 intelligent network, which has been standardized to be in line with the GSM system. The CAMEL concept has been described in closer detail in the GSM specifications 02.78 and 03.78.

In an arrangement according to Figure 2, queuing can be implemented by the intelligent network service control point SCP and certain supplementary services known per se in the GSM system, for example. For example, a supplementary service for call completion to busy subscriber CCBS has been standardized in phase 2+ of the GSM system, in which supplementary service, when an attempt is made to call a busy number, the network monitors when the busy number is released and, subsequently, informs the caller that the number is currently free. If the caller replies to the network's announcement about the released number, only then does the network establish
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a connection to the (busy) number originally called. If the caller does not reply to the network's announcement about the released number, the CCBS service is removed from the network as far as the present call is concerned. Hence, when a call is made to a busy or otherwise unreachable number, the network
5 comprises subscriber status information on each such number, in other words whether the number is idle, i.e. free, or not idle, i.e. busy, or not connected to the network.

According to the invention, the subscriber numbers to which queuing is to be arranged can be registered in the mobile communication network,
10 preferably in the home location register HLR, to be part of a so-called automatic call distribution system ACD. It has then been specified in the information in the home location register of the subscriber number that the number at issue is an ACD number, in which case all incoming calls for the subscriber number at issue to the gateway mobile services switching centre GMSC are
15 connected to the control point SCP. Typically, these ACD numbers are different service numbers, in which case the called service number and the ACD numbers to which the calls received by said service number are connected are different numbers. The called service number does not necessarily have to be a number in accordance with a mobile-network-specific numbering system but
20 the service number may preferably comprise one or more numbers on the basis of which the gateway mobile services switching centre GMSC identifies the called number as the service number to be transmitted to the control point. The service number can, for example, be of the format 0800-12345, wherein
25 the number sequence 0800 indicates to the gateway mobile services switching centre GMSC that the number at issue is a service number described above.

The above-described CCBS service subscriber status information associated with the ACD numbers is transmitted from the network, typically from the gateway mobile services switching centre GMSC, to the control point SCP. INAP signalling can preferably be used for transmitting the information.
30 Also the necessary information for locating mobile subscribers is transmitted to the control point SCP. This can preferably be carried out in connection with location updates of the mobile subscribers in the mobile communication system, whereby the visited mobile services switching centres VMSC transmit the location information on the mobile subscribers to the control point SCP by using MAP or INAP signalling, for example. As far as the control point SCP is concerned, the essential information obtained in connection with the location



update is to which visited mobile services switching centre VMSC the mobile subscriber is connected at a given time. Hence, when the mobile subscriber enters the area of a new mobile services switching centre VMSC, the control point SCP requests said new mobile services switching centre VMSC to monitor the mobile subscriber. According to the invention, call queuing is implemented at the gateway mobile services switching centre GMSC, which informs the control point SCP if a call is made to a service number connected to the ACD number/numbers. The subscriber status information and the location information on each ACD subscriber are stored in the control point SCP. The control point SCP checks the status of the called subscriber and gives the gateway mobile services switching centre GMSC instructions either to preserve the call in the queue if the called number is busy, or to connect the call to the called number if the number is free or when the number becomes released. The control point SCP is preferably arranged to queue up the made calls to a given ACD number in order of arrival at the gateway mobile services switching centre GMSC. Similarly, the control point SCP gives the gateway mobile services switching centre GMSC instructions to connect calls to said ACD number in the queuing order.

According to a preferred embodiment of the invention, a mobile station registered as an ACD subscriber informs the intelligent network service, typically directly the service control point SCP, of its activation status, i.e. whether said mobile station is ready to receive calls according to the ACD service. Hence, the user of the mobile station can, on arrival at work, for example, connect himself or herself to the ACD service by informing the control point SCP that his or her activation status is *on-duty*. Similarly, when leaving work, the user can register *off-duty* as his or her activation status, in which case the control point SCP removes the mobile station from a queue build-up list of the ACD calls. Data transmission between the mobile station and the control point can preferably be carried out as direct wireless data transmission, for example by using a short message service SMS or unstructured supplementary service data USSD. The USSD supplementary service enables operator-specific supplementary service messages to be transmitted both from the mobile station to the network and vice versa. The USSD supplementary service messages can be formed such that they need not be in accordance with a standard. The data transmission can also be implemented such that the information on the basis of which the mobile station acknowledges that it is

located in a given localised service area LSA, in the area of an office cell, for example, is stored in the memory of the mobile station, and the mobile station is programmed to transmit, in response to such an acknowledgement, the above-described activation message to the control point SCP. In addition to
5 location, LSA specifications may comprise time specifications to restrict the transmission of activation messages to business hours only, for example.

In the following, updating an activation status of a mobile station registered as an ACD subscriber will be described in closer detail on the basis of Figure 3. In accordance with a preferred embodiment of the invention, the
10 ACD subscriber himself or herself controls the control point SCP to start and stop monitoring the subscriber-specific ACD service. This means that the ACD subscriber informs the control point SCP of changes in his or her activation status, and the control point SCP carries out the monitoring according to said activation status. In the signalling diagram according to Figure 3, the activation
15 status of the ACD subscriber is first *off-duty*, in which case the control point SCP has not connected said mobile station to a receiving list of the ACD service; consequently, no calls according to the ACD service will be routed to the mobile station. When the ACD subscriber is ready to receive ACD calls, on arrival at work, for example, the ACD subscriber informs the control point SCP
20 that his or her activation status is *on-duty*. In response to the change in the activation status, the control point SCP connects the mobile station to the receiving list and starts monitoring the subscriber status information and location information on the mobile station. The control point SCP gives the gateway mobile services switching centre GMSC instructions to route calls to the mobile station on the basis of the subscriber status information. When in *on-duty* status, the ACD subscriber can move in the area of different mobile services switching centres VMSC, and the control point SCP is controlled to start monitoring in the area of the new mobile services switching centre on the basis of the location update messages. When the ACD subscriber wishes to dis-
25 connect from the ACD service, when leaving work, for example, the ACD subscriber informs the control point SCP that his or her activation status is *off-duty*, in which case the control point SCP removes the mobile station from the receiving list of ACD calls and stops monitoring the subscriber status information and location information.
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As to routing calls, the control point SCP thus maintains two different items of status information on each ACD subscriber: the ACD service acti-

vation status information and the CCBS supplementary service subscriber status information. The ACD service activation status information can be either *on-duty* or *off-duty*. If the ACD subscriber activation status information is *off-duty*, no subscriber status information needs to be maintained. If, on the other
5 hand, the ACD subscriber activation status information is *on-duty*, the subscriber status information is updated to be either 'idle' or 'not idle'. The ACD subscriber is 'not idle' if the number of the subscriber is busy or the mobile station is not connected to the network.

Figure 4 illustrates signalling according to the invention, wherein the
10 ACD subscriber is connected to the ACD service and receives an ACD call. The ACD subscriber (MS) registered at the outset of the signalling sends the control point SCP a status message (41) in which the ACD subscriber announces that his or her ACD service activation status is *on-duty*. The control point SCP starts monitoring the subscriber status information on the ACD subscriber at the mobile services switching centre VMSC in whose area the mobile station MS of the ACD subscriber is located. A control message (startMonitoring(Attendant), 42) is transmitted to the mobile services switching centre VMSC, whereby the mobile services switching centre VMSC starts monitoring the ACD subscriber, and the mobile services switching centre
15 VMSC returns the current subscriber status information 'idle' (idle, 43) in response to said control message. Hence, the control point SCP detects that the ACD subscriber is ready to receive ACD calls. Calls received by the service number are directed to the gateway mobile services switching centre GMSC, which informs the control point SCP that a call is being made to said ACD number. The control point SCP checks the status of the called subscriber and, since the status of the number is 'idle', gives the gateway mobile services switching centre GMSC instructions (connect(Attendant), 44) to direct the call to the called number. The gateway mobile services switching centre GMSC gives a call setup command (setup(Attendant), 45) to the visited mobile services switching centre VMSC, which further connects the call (setup, 46) to the number of the ACD subscriber. At the same time, the mobile services switching centre VMSC informs the control point SCP that the subscriber status information of the ACD subscriber has changed, currently being 'not idle' (notidle, 47). When the call to the ACD subscriber ends, the visited mobile services switching centre VMSC is informed of this (release, 48), and the visited mobile services switching centre VMSC further informs the control point
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SCP that the subscriber status information on said ACD subscriber has changed again, currently being 'idle' (idle, 49). The control point SCP then knows that the ACD subscriber is ready again to receive ACD calls.

In order to simplify the invention, a situation has been described above wherein one ACD subscriber receives incoming calls to a given ACD service number. Said service numbers can also be implemented such that a given telephone service may comprise one or more telephone numbers, and incoming calls to these numbers are routed further to a plurality of ACD subscribers. The number of the telephone numbers and the ACD subscribers does not have to be identical. In the following, the signalling diagram according to Figure 5 will illustrate how queuing and call distribution are arranged according to the invention in a situation in a mobile communication network wherein incoming calls to one ACD service number are routed to a plurality of ACD subscribers. The control point SCP monitors ACD subscribers connected to visited mobile services switching centres VMSC. In the situation according to Figure 5, the subscriber status information on all ACD subscribers registered in the same ACD service number is 'not idle', in which case new incoming calls to said ACD service number must be arranged in a queue. For example, a call is made from a public switched telephone network PSTN to said ACD service number, in which case the call (setup(serviceNumber), 51) is first connected to the gateway mobile services switching centre GMSC, which further activates (initialDP(serviceNumber), 52) the call control system controlled by the control point SCP. The call control system of the control point SCP is now responsible for call control. Since all ACD subscribers are 'not idle', the control point SCP places the received call in the queue and connects an announcement (playAnnouncement, 53) to the caller indicating that the call is in the queue. Hence, the entire logic necessary for arranging the queuing can preferably be implemented at the control point SCP. The control point SCP is all the time ready to receive information from the visited mobile services switching centres VMSC on the subscriber status information about the ACD subscribers connected thereto. When an ACD subscriber is released, i.e. the subscriber status information changes from 'non idle' to 'idle', a corresponding visited mobile services switching centre VMSC informs the control point SCP of this (idle, 54). The control point SCP gives the gateway mobile services switching centre GMSC a command (connect(freeAttendant), 55) to connect the first call in the queue to the released ACD number. If several ACD numbers

are released substantially simultaneously, the control point can select the ACD number for the call on the basis of the location of the terminal, for example. In response to the connect command, the gateway mobile services switching centre GMSC gives the visited mobile services switching centre VMSC a call setup command (setup(freeAttendant), 56). The last call which originally arrived at the gateway mobile services switching centre GMSC is always placed last in the queue, whereas the first call in the queue is preferably connected to the ACD number being released.

The telephone service can also be implemented such that the service comprises a plurality of ACD numbers, each of the numbers being connected to one terminal. In such a case, the ACD subscriber is connected to the ACD service and the calls are routed to the terminal in a manner described above in connection with Figure 4. As far as customer service is concerned, a problem may present itself in a situation wherein one ACD number receives several calls that are arranged in a queue while other terminals may simultaneously be free. In accordance with a preferred embodiment of the invention, this can be solved such that the control point SCP monitors all ACD numbers connected to the same telephone service, and, before the calls are arranged in a queue, checks also the subscriber status information on the other ACD subscribers. If any of the other ACD subscribers is free, the control point SCP gives the gateway mobile services switching centre GMSC instructions to connect the call received by the busy ACD number to a free ACD number.

A situation may occur in different service numbers wherein a received call needs to be transferred to another number. For example, in connection with various expert services, another expert might be more familiar with the problem at issue than the one answering the call, so it is wiser to forward the call to this other expert. A problem then arises if the number to which the call is being transferred does not answer. As far as the customer service is concerned, it would be desirable that the transferred call would return to the originally called number which carried out the transfer during a determined period, but a new call may then already have been connected to the number which carried out the transfer. According to a preferred embodiment of the invention, this can be avoided by using an arrangement described by the signalling diagram according to Figure 6.

In Figure 6, the control point SCP further monitors the visited mobile services switching centres VMSC and the ACD subscribers connected thereto

and the subscriber status information on the ACD subscribers. If any ACD subscriber transfers a call, the mobile services switching centre VMSC informs the control point SCP of this (notify(invokedCT), 61). Furthermore, the mobile services switching centre VMSC informs the control point SCP that the subscriber status information on said ACD subscriber has changed into 'idle' (idle, 62). In response to this, the control point SCP starts a timer, and the call can be returned to the number which transferred the call during a guard time period set for the timer. If the transferred call is not returned during the predetermined guard time period, said ACD subscriber can receive new calls after the guard time is over.

According to a preferred embodiment of the invention, the invention can be alternatively implemented such that the home location register HLR of the mobile communication network monitors the subscriber status information and the location information on the ACD subscribers. The home location register HLR then receives information from the visited mobile services switching centres VMSC on the changes in the subscriber status information and location updates of the ACD subscribers preferably by using the known MAP signalling. The implementation of the present embodiment of the invention requires that a special signalling protocol be created between the control point 15 SCP and the home location register HLR, said protocol enabling the control point SCP to request the home location register HLR to start or stop monitoring a given ACD subscriber. Furthermore, the protocol should enable the home location register to report the changes in the subscriber status information and the location information on the ACD subscribers to the control point 20 SCP. An advantage of the present embodiment of the invention is that the method of the invention supports roaming in other mobile communication networks VPLMN also using the CCBS supplementary service. A further advantage is that the visited mobile services switching centre VMSC does not need to inform the control point SCP of the location updates of the ACD subscribers. 25 The implementation of the control point SCP can also be simplified by using the described procedure.

It is obvious to one skilled in the art that as technology advances, the basic idea of the invention can be implemented in many different ways. The invention can be implemented particularly in any telecommunication system comprising essential parts as far as the implementation of the invention is concerned. The invention and its embodiments are thus not restricted to the 35 concerned.

above-described examples but they can vary within the scope of the attached claims.

CLAIMS

1. A method for transmitting calls in a mobile communication system comprising at least one mobile services switching centre, a service control point for an intelligent network and at least one terminal communicating with the mobile services switching centre, **characterized by**
 - 5 transmitting subscriber status information and location information on the terminal to the intelligent network service control point,
 - transmitting information on an incoming call to a call number from the mobile services switching centre to the service control point,
 - 10 selecting, at the service control point, a first terminal to which the call received by the call number is to be directed,
 - checking, at the service control point, subscriber status information on said first terminal, and
 - transmitting a command from the service control point to the mobile services switching centre to alternatively:
 - 15 connect the call to said first terminal in response to the fact that the subscriber status information on said terminal indicates that the terminal is able to receive the call or
 - arrange the incoming call in a queue in response to the fact that the subscriber status information on said first terminal indicates that the terminal has such a status which does not allow the terminal to receive the call.
2. A method as claimed in claim 1, **characterized by**
 - 20 checking, at the service control point, subscriber status information on a second terminal in response to the fact that said call number is common to a plurality of terminals and the subscriber status information on said first terminal indicates that the terminal has such a status which does not allow the terminal to receive the call, and
 - 25 transmitting a command from the service control point to the mobile services switching centre to connect the call to said second terminal in response to the fact that the subscriber status information on said second terminal indicates that the terminal is able to receive the call.
3. A method as claimed in claim 1, **characterized by**
 - 30 checking, at the service control point, the subscriber status information on the terminal assigned to a second call number in response to the fact that a telephone service comprises a plurality of terminal-specific call numbers

and the subscriber status information on said first terminal indicates that the terminal has such a status which does not allow the terminal to receive the call, and

transmitting a command from the service control point to the mobile services switching centre to connect the call to the terminal assigned to said second call number in response to the fact that the subscriber status information on said terminal indicates that the terminal is able to receive the call.

4. A method as claimed in any one of the preceding claims,
characterized by

10 maintaining information on the calls in the queue at said service control point.

5. A method as claimed in claim 4, **characterized by**
transmitting a command from said control point to the mobile services switching centre to connect a first call in the queue to said terminal in response to the fact that the subscriber status information on said terminal changes such that it indicates that the terminal is able to receive the call.

6. A method as claimed in any one of the preceding claims,
characterized by

20 registering said terminal in advance in an automatic call distribution system.

7. A method as claimed in claim 6, **characterized by**
activating said terminal in said automatic call distribution system such that an activation message is transmitted from the terminal to said control point.

25 8. A method as claimed in any one of the preceding claims,
characterized by

transferring the call from the terminal to a third party,
informing the service control point of the call being transferred by said terminal,

30 starting a timer at the service control point in response to the fact that the subscriber status information on said terminal has been changed such that it indicates that the terminal is able to receive the call, and

reconnecting the call to said terminal in response to the fact that said third party does not answer the call during a period of time determined by said timer.

35

9. A method as claimed in any one of the preceding claims,
characterized by

maintaining the subscriber status information and the location information on the terminal in a home location register of the mobile communication network, and

transmitting said information to the intelligent network service control point.

10. A method as claimed in any one of the preceding claims,
characterized in that

the mobile communication system comprises a gateway mobile services switching centre and at least one visited mobile services switching centre.

11. A method as claimed in any one of the preceding claims,
characterized by

selecting, at the service control point, said terminal on the basis of the location information on the terminal.

12. A method as claimed in any one of the preceding claims,
characterized in that

said subscriber status information on the terminal is subscriber status information on a CCBS supplementary service according to a GSM system, and said location information is location information according to the GSM system.

13. A mobile communication system comprising at least one mobile services switching centre, a service control point for an intelligent network and at least one terminal communicating with the mobile services switching centre,
characterized in that

the mobile services switching centre is arranged to transmit subscriber status information and location information on the terminal to the intelligent network service control point,

the mobile services switching centre is arranged to inform the service control point of an incoming call to a call number,

the service control point is arranged to select a first terminal to which the call received by the call number is to be directed, to check subscriber status information on said first terminal, and to transmit a command to the mobile services switching centre to alternatively:

connect the call to said first terminal in response to the fact that the subscriber status information on said terminal indicates that the terminal is able to receive the call or

5 arrange the incoming call in a queue in response to the fact that the subscriber status information on said first terminal indicates that the terminal has such a status which does not allow the terminal to receive the call.

14. A mobile communication system as claimed in claim 13, **characterized** in that

10 the service control point is arranged to check subscriber status information on a second terminal in response to the fact that said call number is common to a plurality of terminals and the subscriber status information on said first terminal indicates that the terminal has such a status which does not allow the terminal to receive the call, and

15 to transmit a command to the mobile services switching centre to connect the call to said second terminal in response to the fact that the subscriber status information on said second terminal indicates that the terminal is able to receive the call.

15. A mobile communication system as claimed in claim 13, **characterized** in that

20 the service control point is arranged to check the subscriber status information on the terminal assigned to a second call number in response to the fact that a telephone service comprises a plurality of terminal-specific call numbers and the subscriber status information on said first terminal indicates that the terminal has such a status which does not allow the terminal to receive the call, and

25 to transmit a command to the mobile services switching centre to connect the call to the terminal assigned to said second call number in response to the fact that the subscriber status information on said terminal indicates that the terminal is able to receive the call.

30 16. A mobile communication system as claimed in any one of claims 13 to 15, **characterized** in that

35 said service control point is arranged to maintain information on the calls in the queue.

17. A mobile communication system as claimed in claim 16, **characterized** in that

said control point is arranged to transmit a command to the mobile services switching centre to connect a first call in the queue to said terminal in response to the fact that the subscriber status information on said terminal changes such that it indicates that the terminal is able to receive the call.

5 18. A mobile communication system as claimed in any one of claims 13 to 17, **characterized** in that

 said terminal is registered in advance in an automatic call distribution system.

10 19. A mobile communication system as claimed in claim 18, **characterized** in that

 said terminal is arranged to be activated in said automatic call distribution system by transmitting an activation message from the terminal to said control point.

15 20. A mobile communication system as claimed in any one of claims 13 to 19, **characterized** in that

 the terminal is arranged to transfer the call to a third party,

 the mobile services switching centre is arranged to inform the service control point of the call being transferred by said terminal,

20 the service control point is arranged to start a timer in response to the fact that mobile services switching centre announces that the subscriber status information on said terminal has been changed such that it indicates that the terminal is able to receive the call, and to control the mobile services switching centre to reconnect the call to said terminal in response to the fact that said third party does not answer the call during a period of time determined by said timer.

25 21. A mobile communication system as claimed in any one of claims 13 to 20, **characterized** in that

 the subscriber status information and the location information on the terminal are arranged to be maintained in a home location register of the mobile communication network, wherefrom the subscriber status information and the location information on the terminal are arranged to be transmitted to the intelligent network service control point.

30 22. A mobile communication system as claimed in any one of claims 13 to 21, **characterized** in that

the mobile communication system comprises a gateway mobile services switching centre and at least one visited mobile services switching centre.

23. A mobile communication system as claimed in any one of
5 claims 13 to 22, **characterized** in that

the service control point is arranged to select said terminal on the basis of the location information on the terminal.

24. A mobile communication system as claimed in any one of
claims 13 to 23, **characterized** in that

10 said subscriber status information on the terminal is subscriber status information on a CCBS supplementary service according to a GSM system, and said location information is location information according to the GSM system.

15 25. A service control point (SCP) for an intelligent network arranged to be operatively connected with at least one mobile services switching centre,
characterized in that

the service control point is arranged to receive and store subscriber status information and location information on terminals, and

20 to control queue build-up and call connecting at the mobile services switching centre on the basis of said subscriber status information and location information.

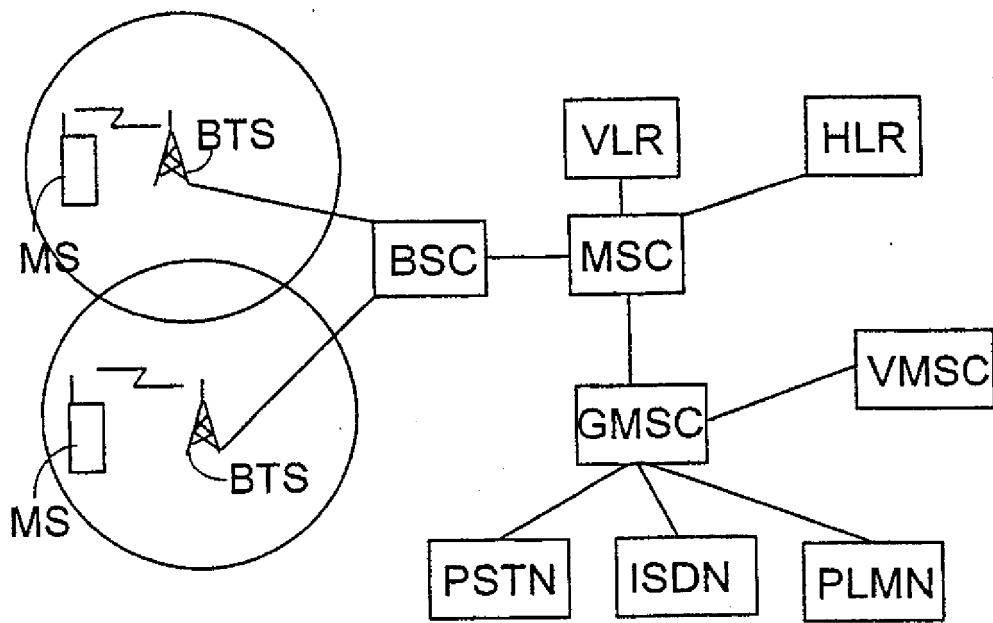


FIG. 1

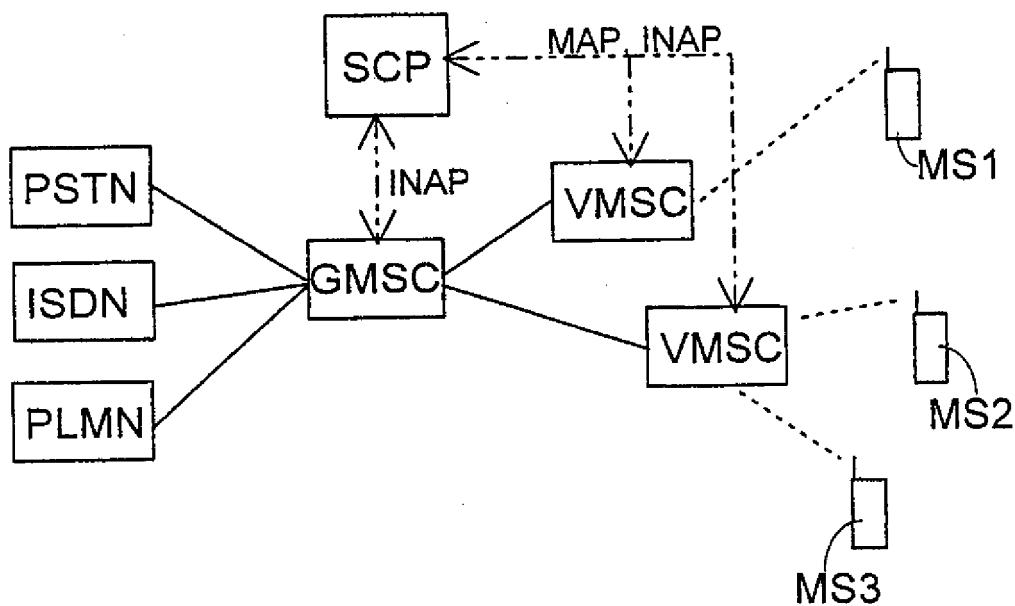


FIG. 2

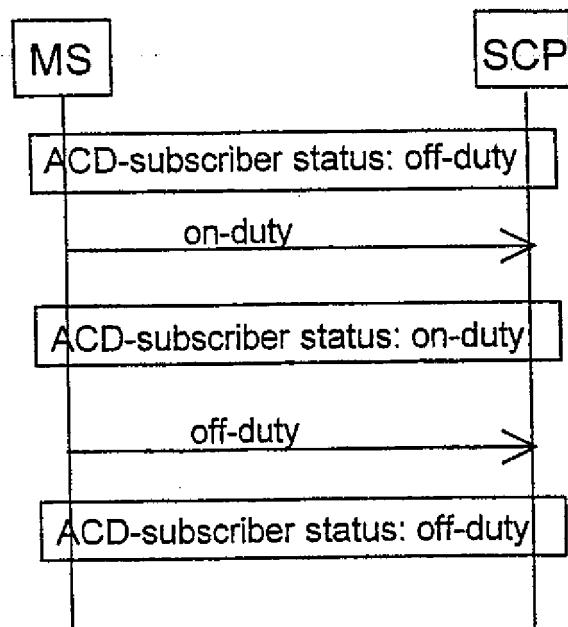


FIG. 3

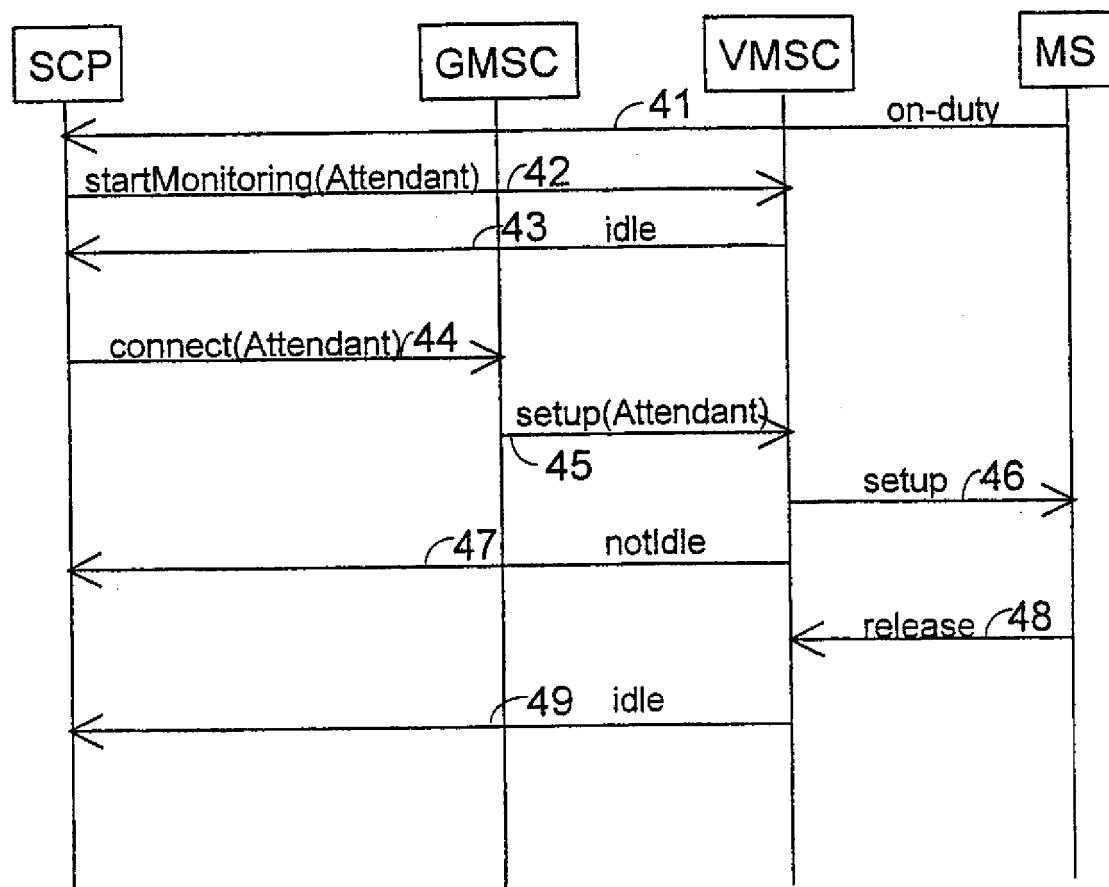


FIG. 4

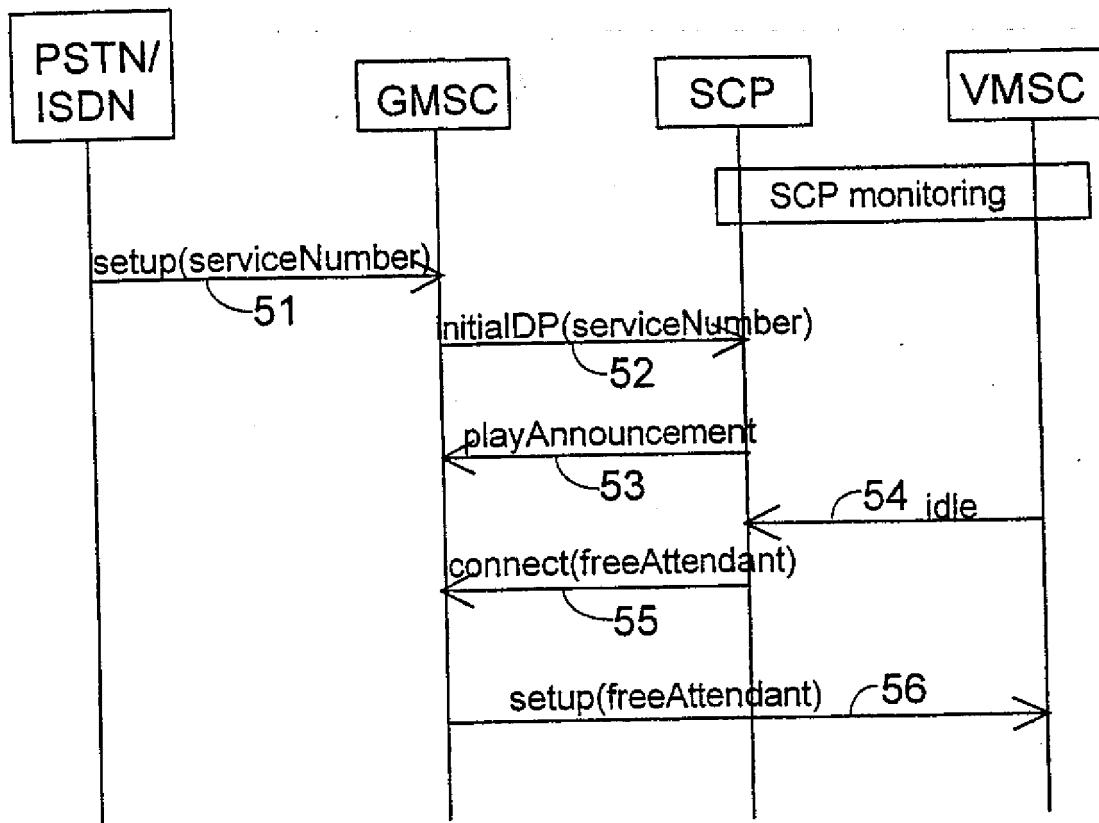


FIG. 5

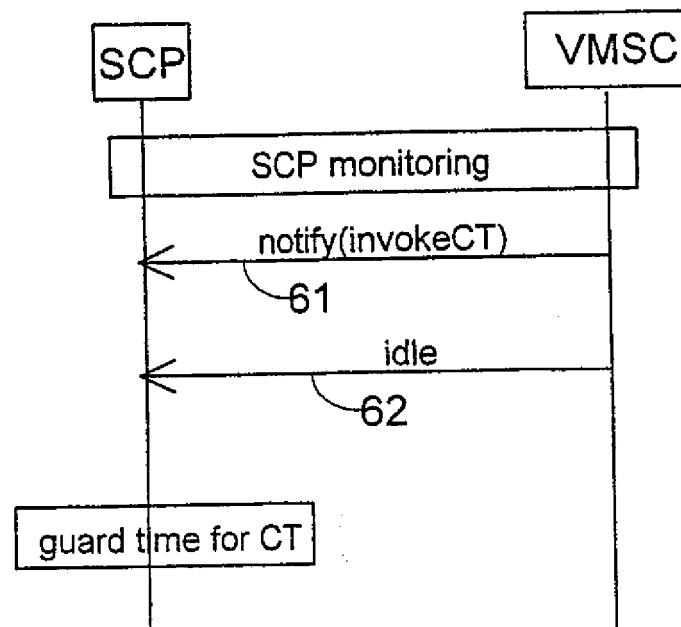


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 00/00578

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 3/00, H04Q 7/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9927744 A1 (ERICSSON INC.), 3 June 1999 (03.06.99), page 3, line 24 - page 4, line 15; page 5, line 11 - page 6, line 9 --	1-25
A	US 5691973 A (RAMSTRÖM ET AL.), 25 November 1997 (25.11.97), column 14, line 4 - line 46; column 20, line 60 - column 21, line 8 --	1-25
A	WO 9825418 A2 (NORTHERN TELECOM LIMITED), 11 June 1998 (11.06.98), page 3, line 5 - line 20 --	1-25

 Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:	
"A"	document defining the general state of the art which is not considered to be of particular relevance
"B"	earlier application or patent but published on or after the international filing date
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O"	document referring to an oral disclosure, use, exhibition or other means
"P"	document published prior to the international filing date but later than the priority date claimed
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"X"	document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y"	document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&"	document member of the same patent family

Date of the actual completion of the international search

1 December 2000

Date of mailing of the international search report

08-12-2000

Name and mailing address of the ISA/

Swedish Patent Office

Authorized officer

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 00/00578

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5841854 A (SCHUMACHER ET AL.), 24 November 1998 (24.11.98), column 5, line 26 - column 6, line 8; column 6, line 59 - column 7, line 52; column 14, line 55 - column 15, line 55 --	1-25
A	EP 0905956 A2 (LUCENT TECHNOLOGIES INC.), 31 March 1999 (31.03.99), column 3, line 36 - column 4, line 15 --	1-25
P,A	WO 9944373 A1 (HELSINGIN PUHELIN OYJ - HELSINGFORS TELEFON ABP), 2 Sept 1999 (02.09.99), page 5, line 28 - page 8, line 21 -- -----	1-25

INTERNATIONAL SEARCH REPORT

Information on patent family members

02/11/00

International application No.

PCT/FI 00/00578

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
WO 9927744 A1	03/06/99	AU	1534099 A	15/06/99
		GB	0014557 D	00/00/00
		GB	2348340 A	27/09/00
		US	5991620 A	23/11/99
US 5691973 A	25/11/97	US	5960004 A	28/09/99
		AU	657155 B	02/03/95
		AU	2232892 A	25/01/93
		BR	9205331 A	21/06/94
		CA	2087097 A	29/12/92
		DE	69230905 D,T	17/08/00
		EP	0546151 A,B	16/06/93
		SE	0546151 T3	
		FI	930855 A	25/02/93
		JP	6500912 T	27/01/94
		MX	9203507 A	31/01/94
		NO	930624 A	23/02/93
		WO	9300776 A	07/01/93
WO 9825418 A2	11/06/98	CA	2242091 A	11/06/98
		CA	2242092 A	11/06/98
		CA	2242094 A	11/06/98
		US	5987115 A	16/11/99
		US	5987116 A	16/11/99
		US	6018579 A	25/01/00
		WO	9825386 A	11/06/98
		WO	9825387 A	11/06/98
		WO	9825392 A	11/06/98
		WO	9825417 A	11/06/98
US 5841854 A	24/11/98	US	5566236 A	15/10/96
		US	5862208 A	19/01/99
EP 0905956 A2	31/03/99	CA	2245305 A	30/03/99
		JP	11191810 A	13/07/99
WO 9944373 A1	02/09/99	FI	3665 U	09/10/98
		FI	980327 A,V	13/08/99
		NO	20003943 D	00/00/00
		SE	0002833 D	00/00/00